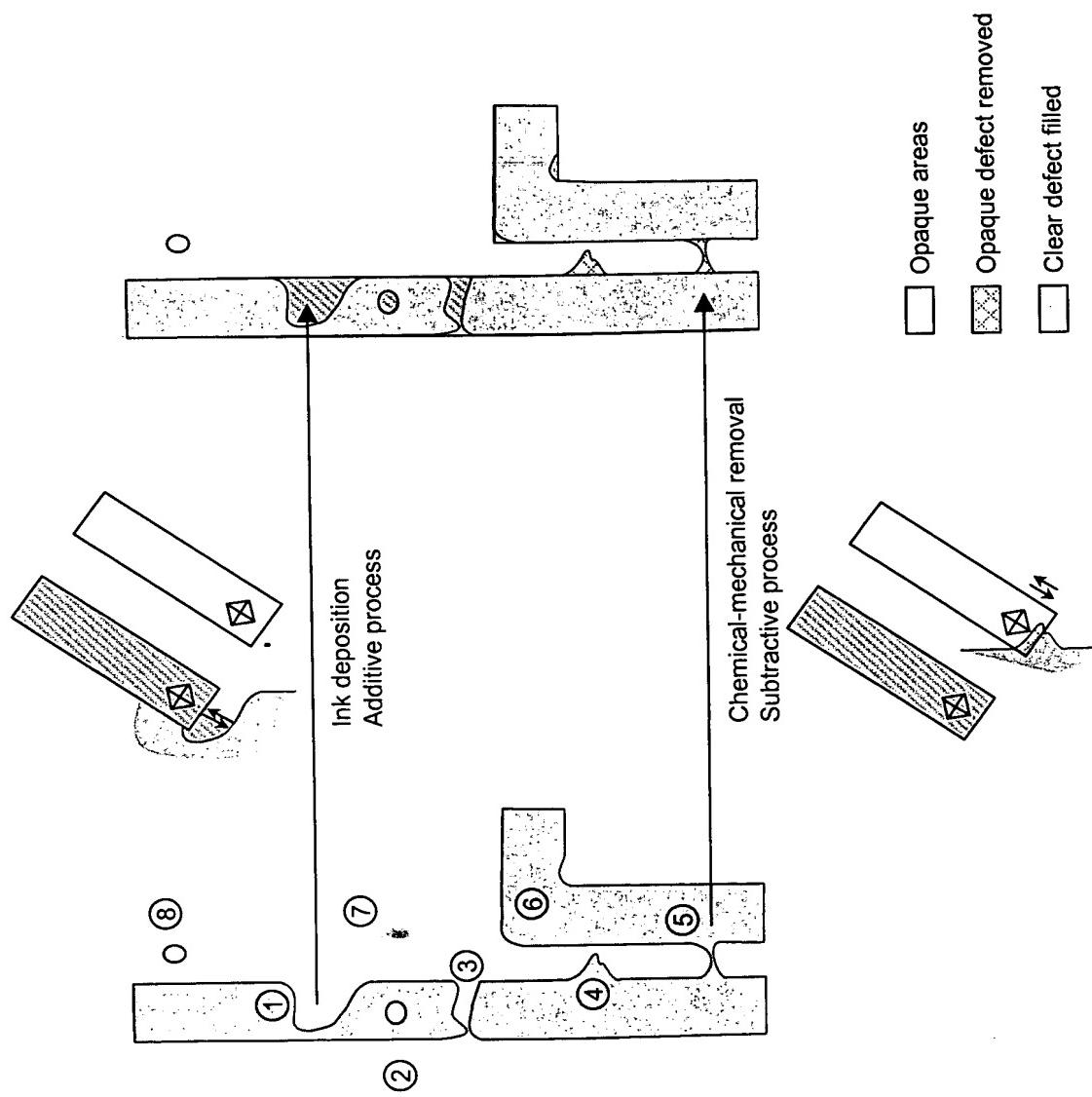
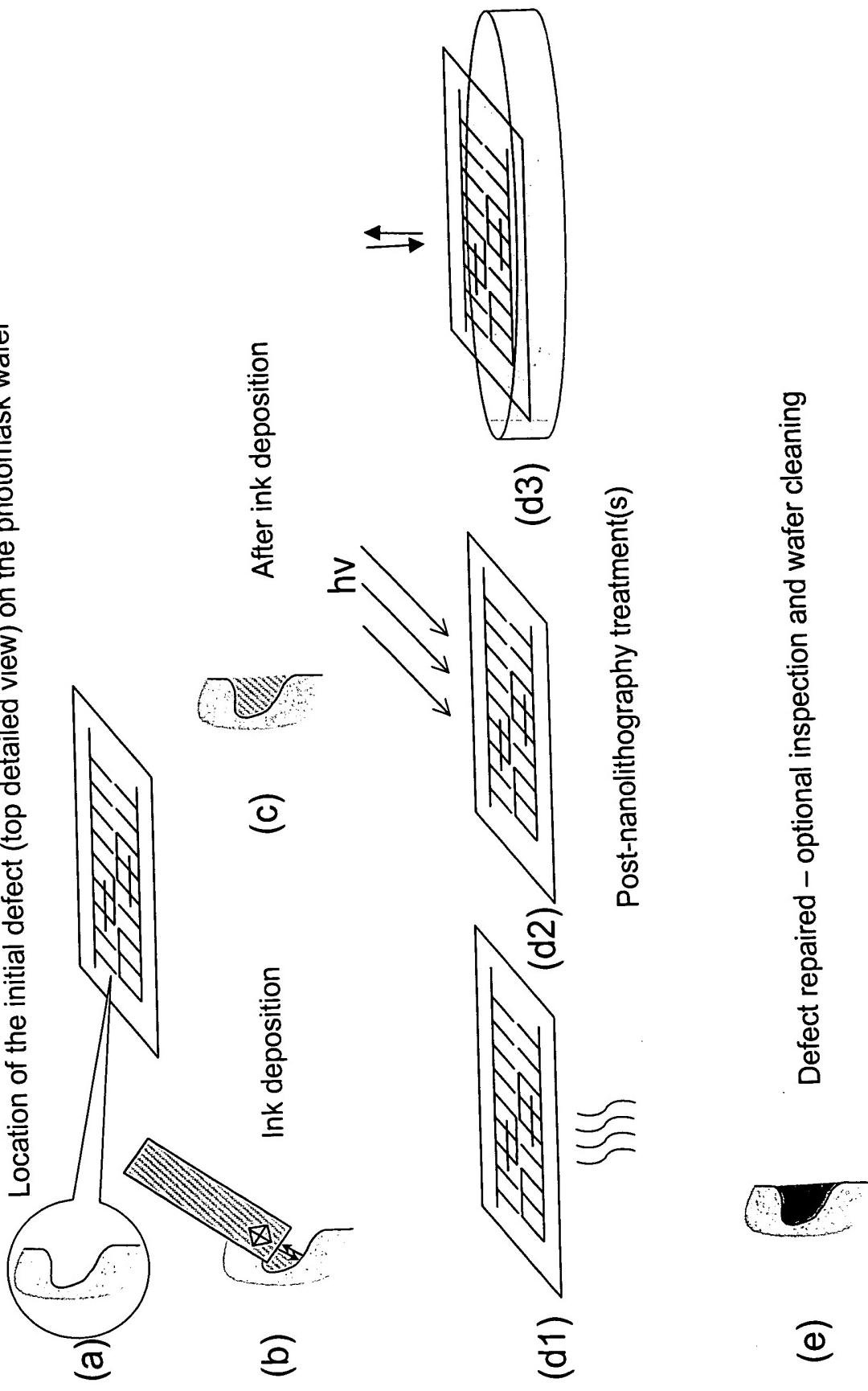


**Figure 1**



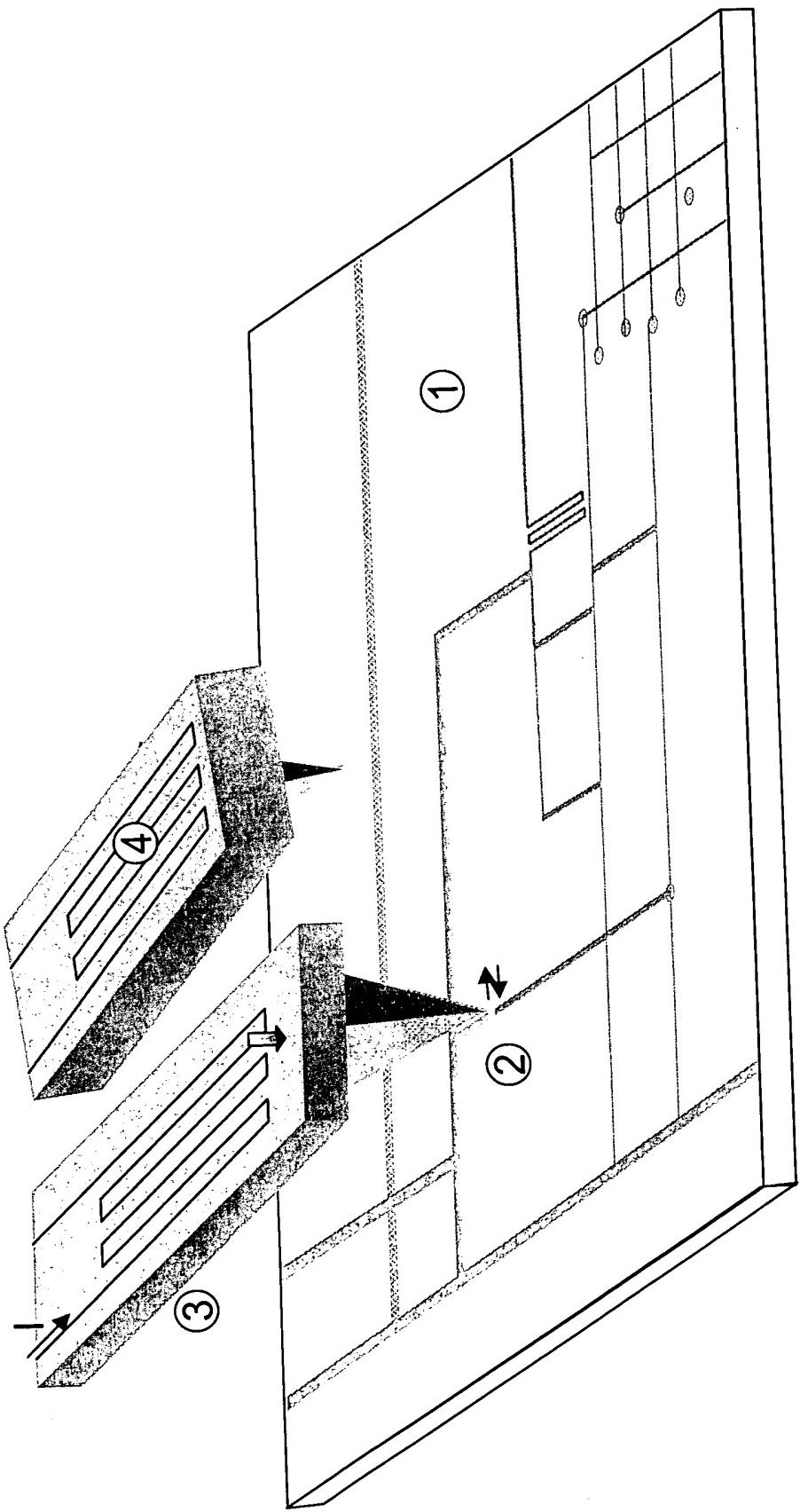
**Figure 2**

Location of the initial defect (top detailed view) on the photomask wafer



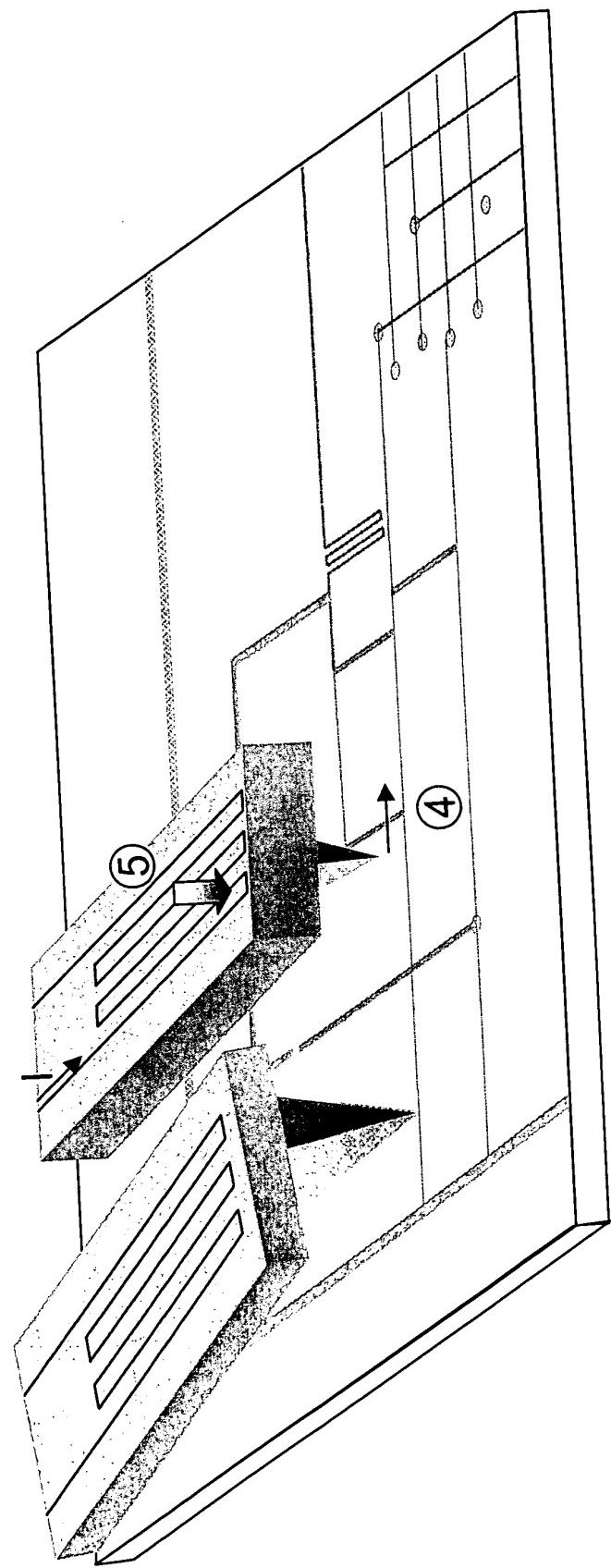
Title: Nanometer-Scale Engineered Structures, Methods  
and Apparatus for Fabrication thereof, and Applications  
to Photomask Repair and Enhancement  
Inventor(s): Percy Van Crocker et al.  
Attorney Docket No.: 083847-0198

**Figure 3A**



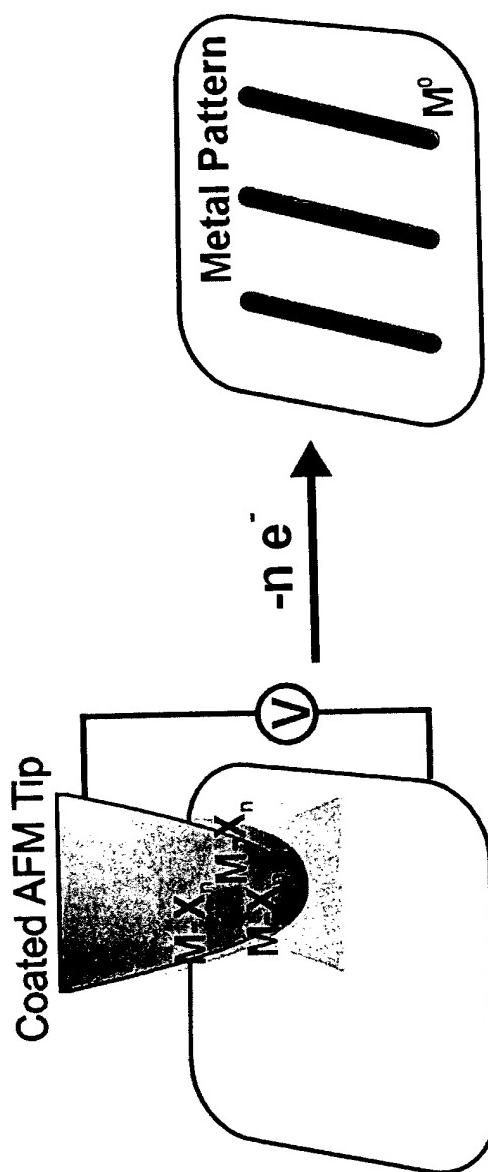
U.S. Nanometer-Scale Engineered Structures, Methods  
and Apparatus for Fabrication thereof, and Applications  
to Photomask Repair and Enhancement  
Inventor(s): Percy Van Crocker et al.  
Attorney Docket No.: 083847-0198

**Figure 3B**



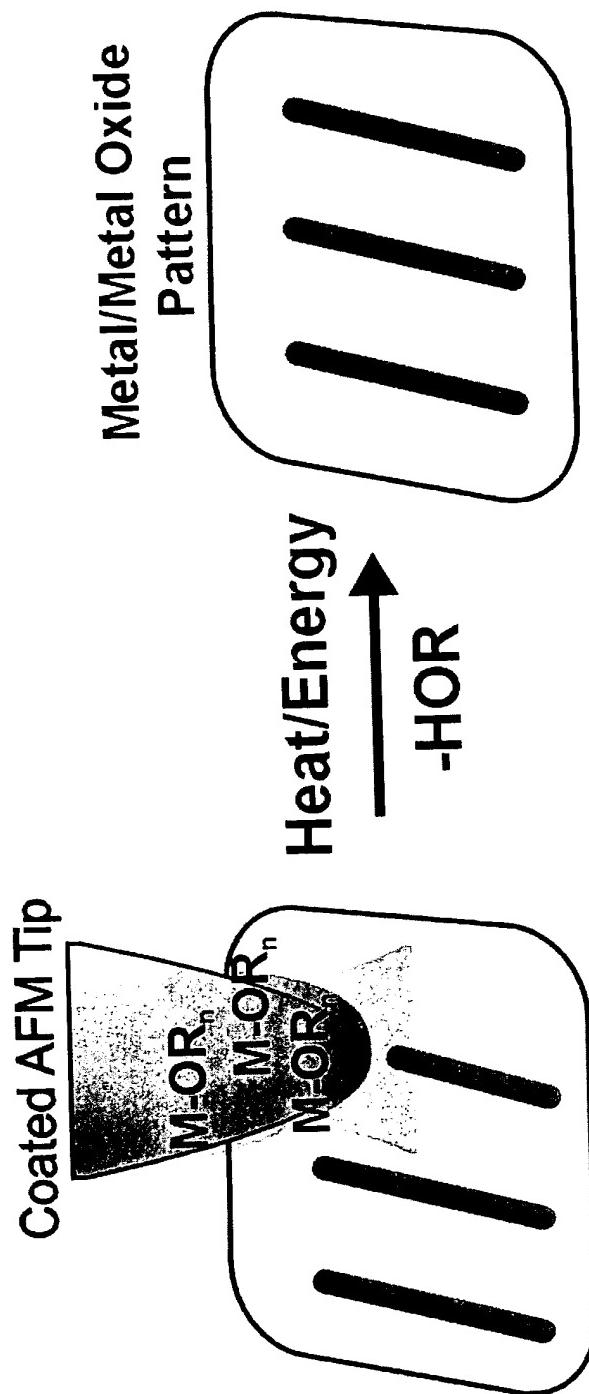
**Title:** Nanometer-Scale Engineered Structures, Methods and Apparatus for Fabrication thereof, and Applications to Photomask Repair and Enhancement  
**Inventor(s):** Percy Van Crocker et al.  
**Attorney Docket No.:** 083847-0198

**Figure 4**

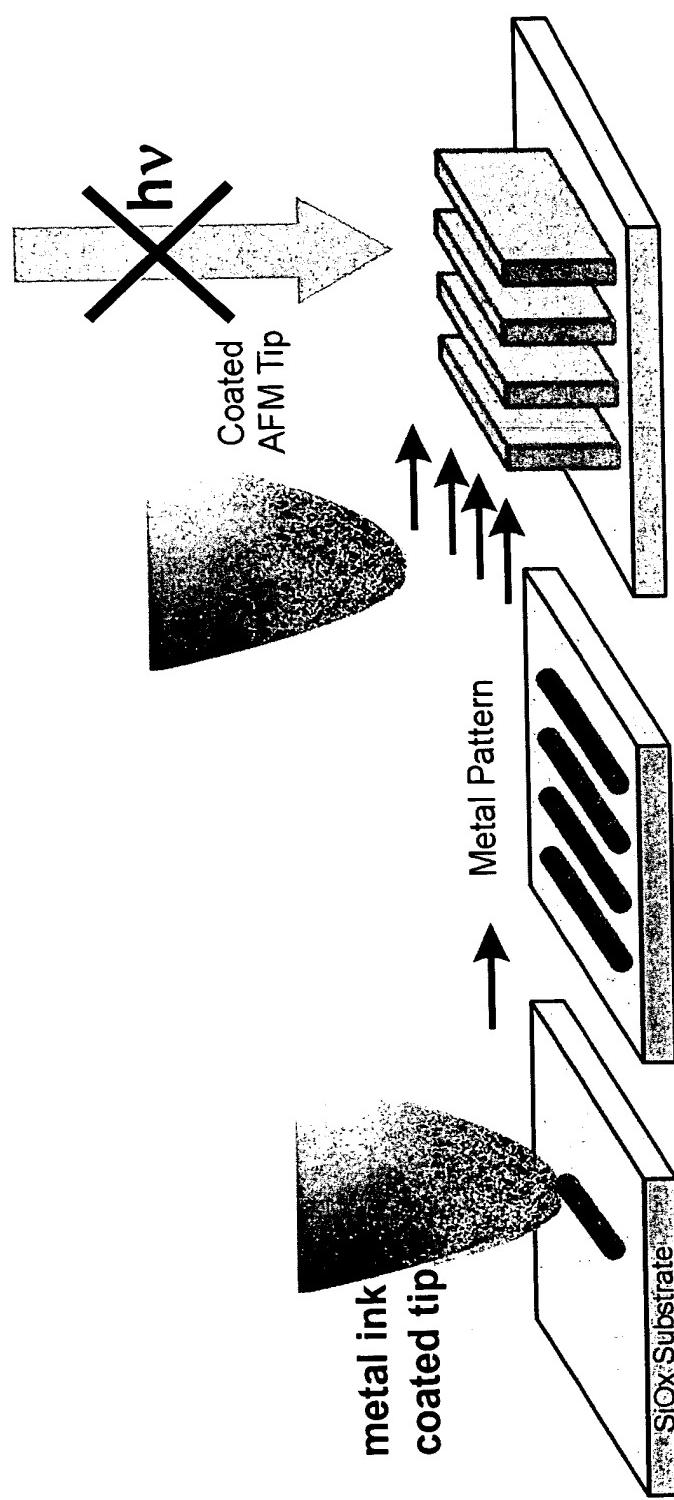


Title: Nanometer-Scale Engineered Structures, Methods  
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Inventor(s): Percy Van Crocker et al.  
Attorney Docket No.: 083847-0198

Figure 5

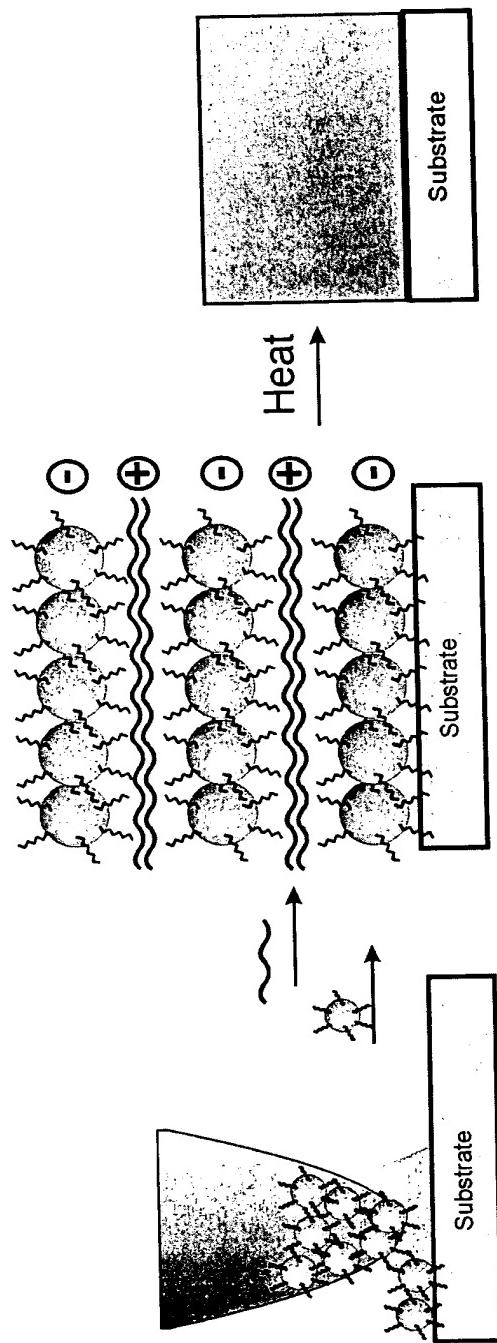


**Figure 6**

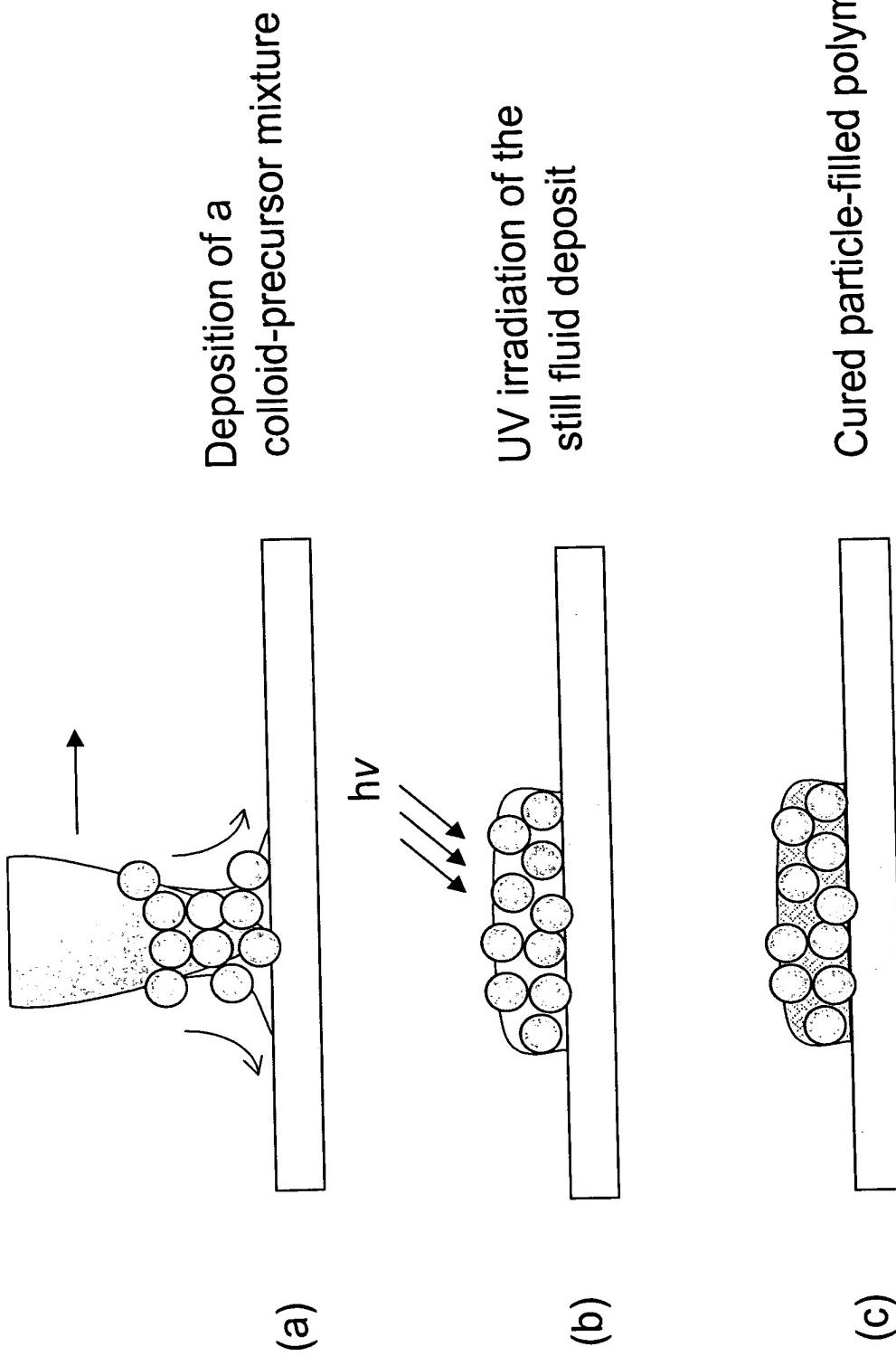


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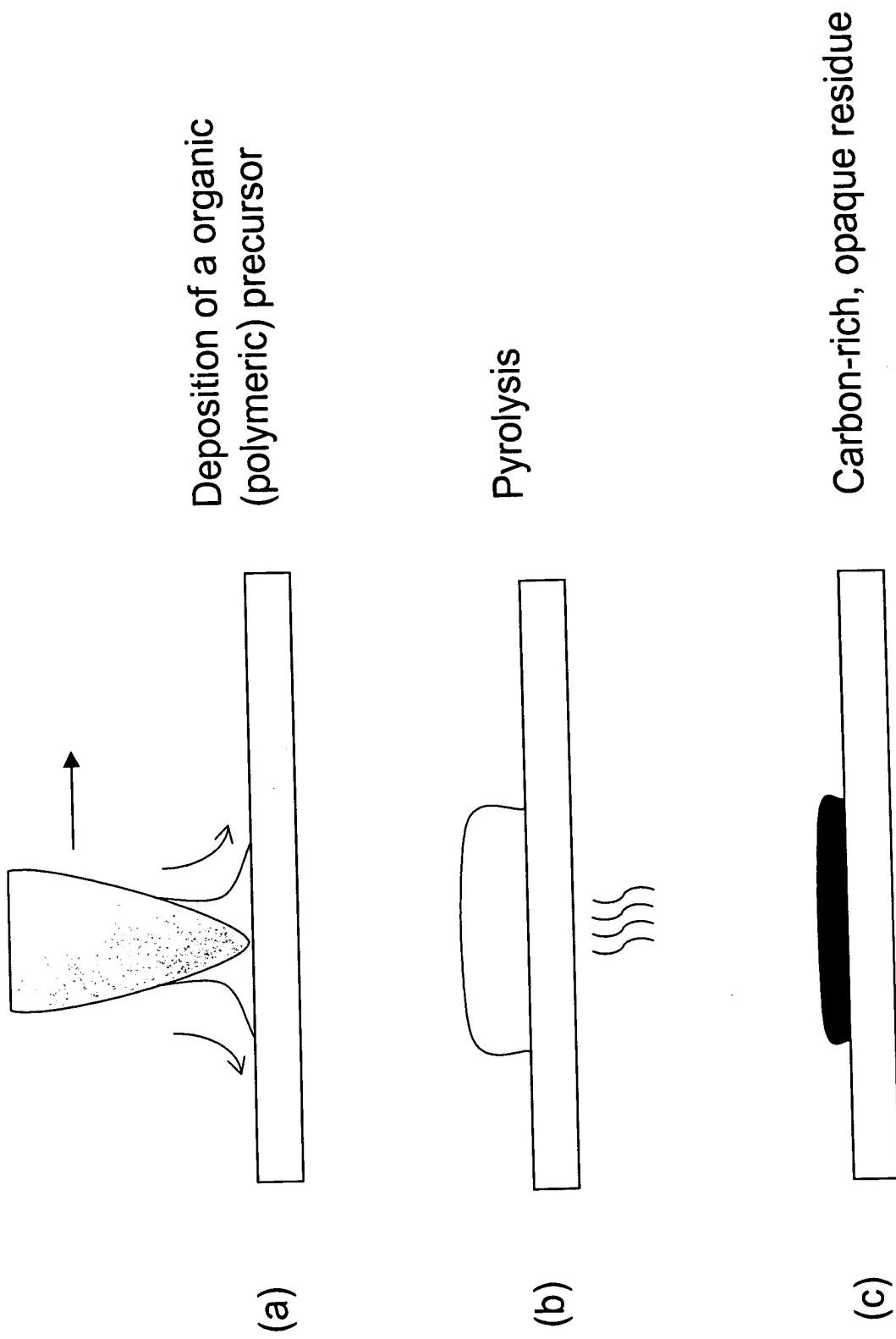
**Figure 7**



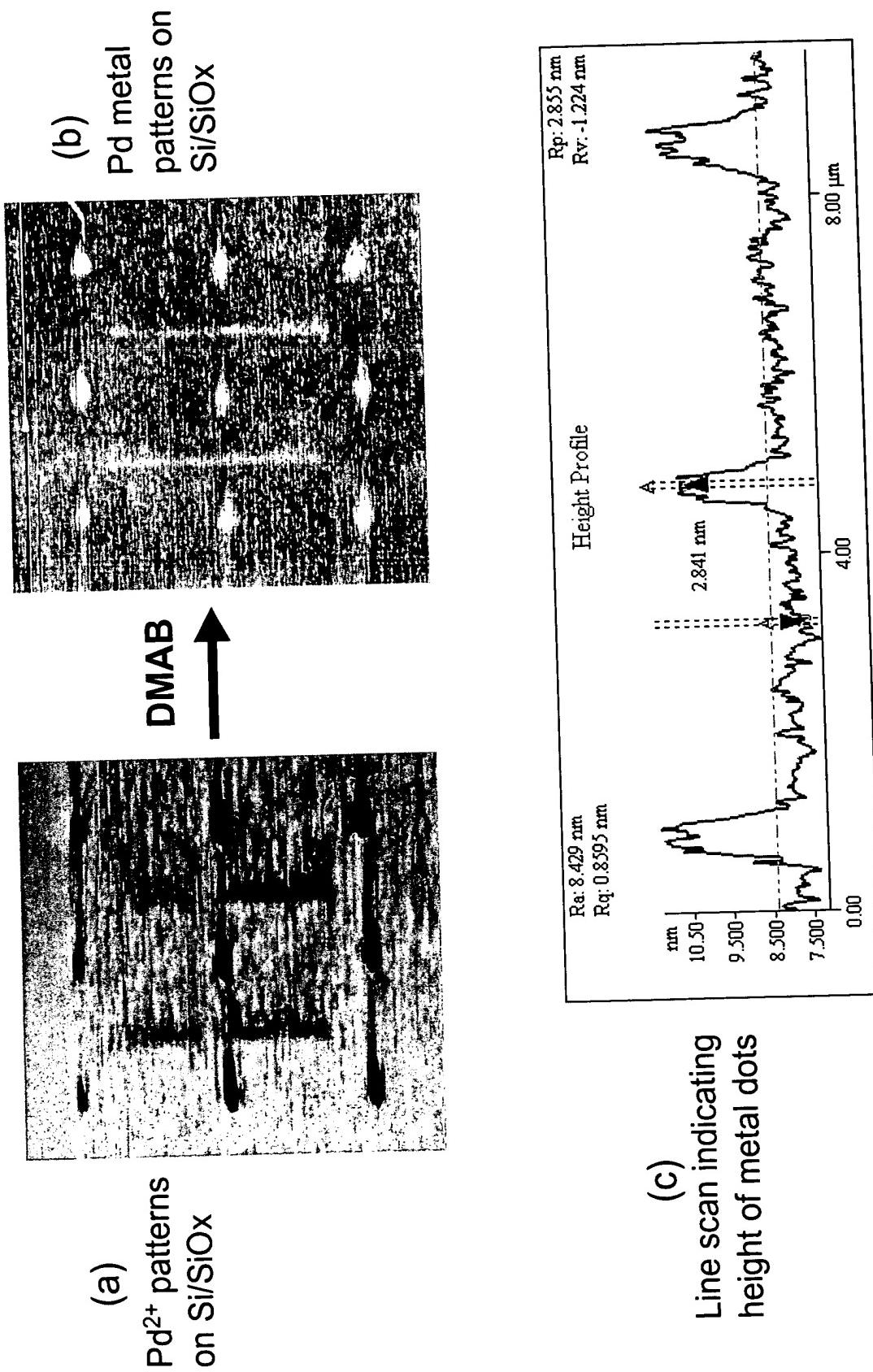
**Figure 8**



**Figure 9**



**Figure 10**



**Figure 11**

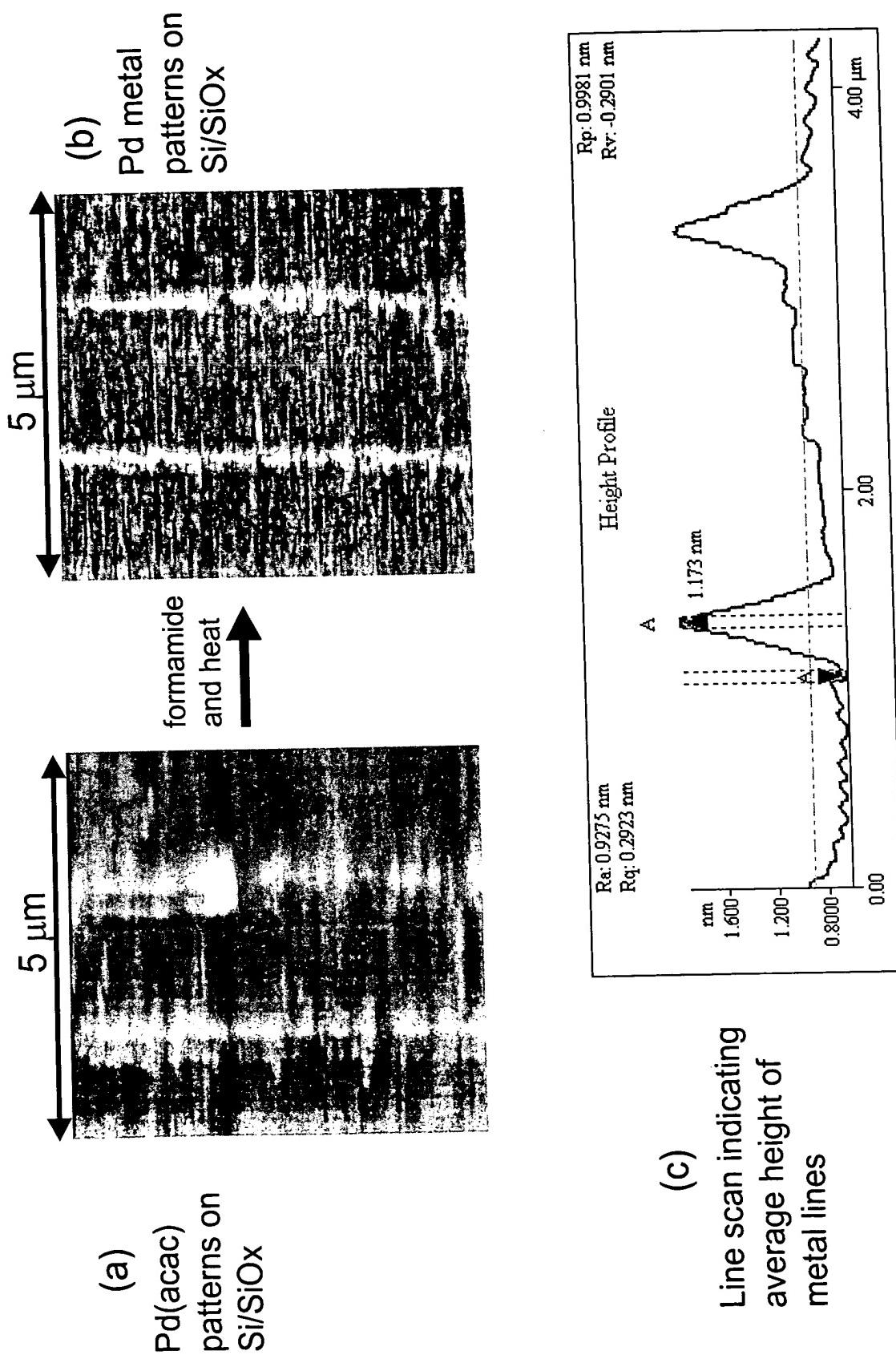
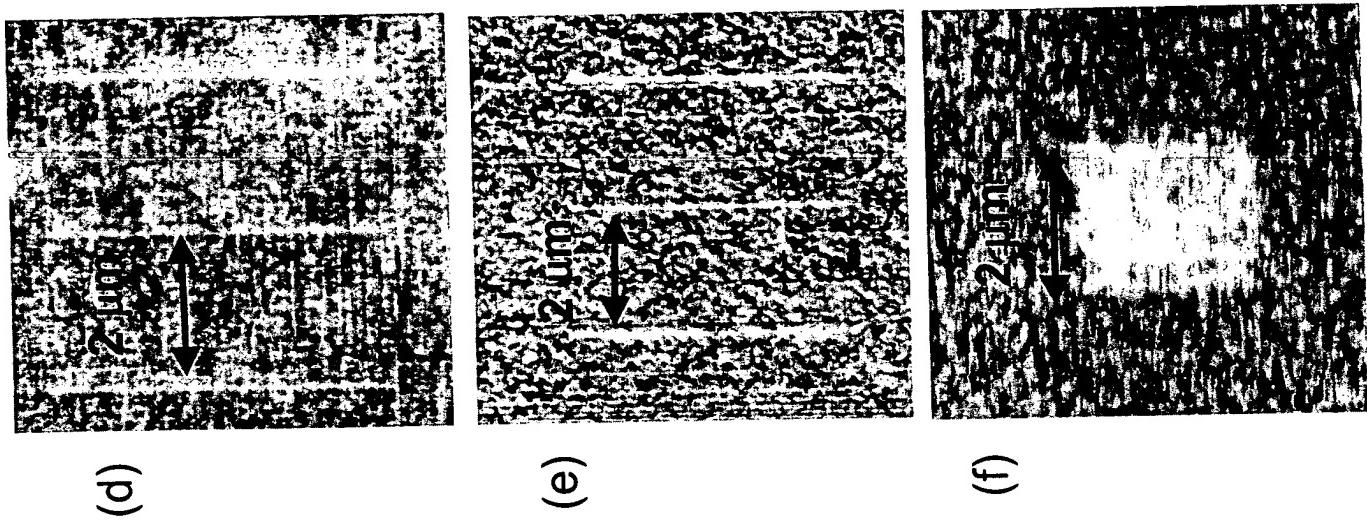


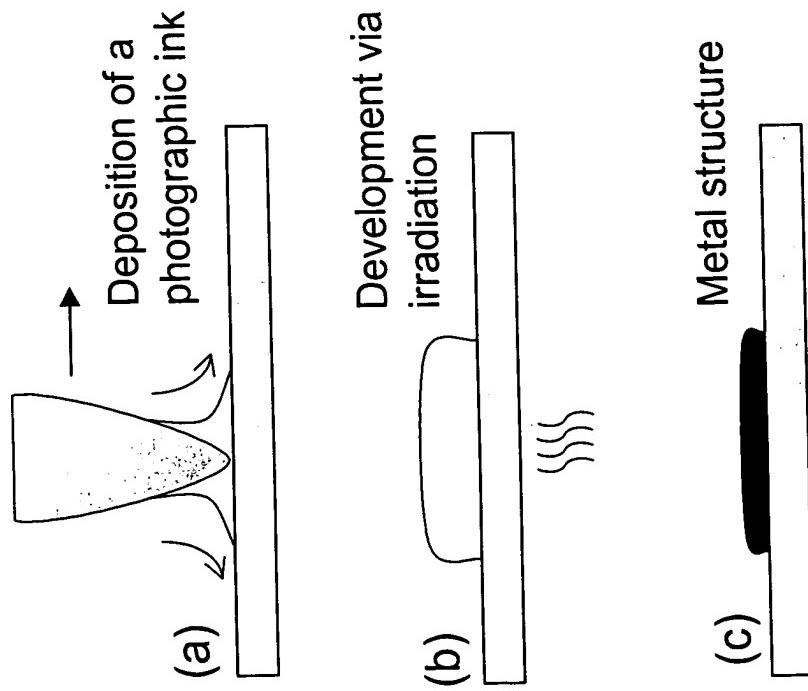
Figure 12

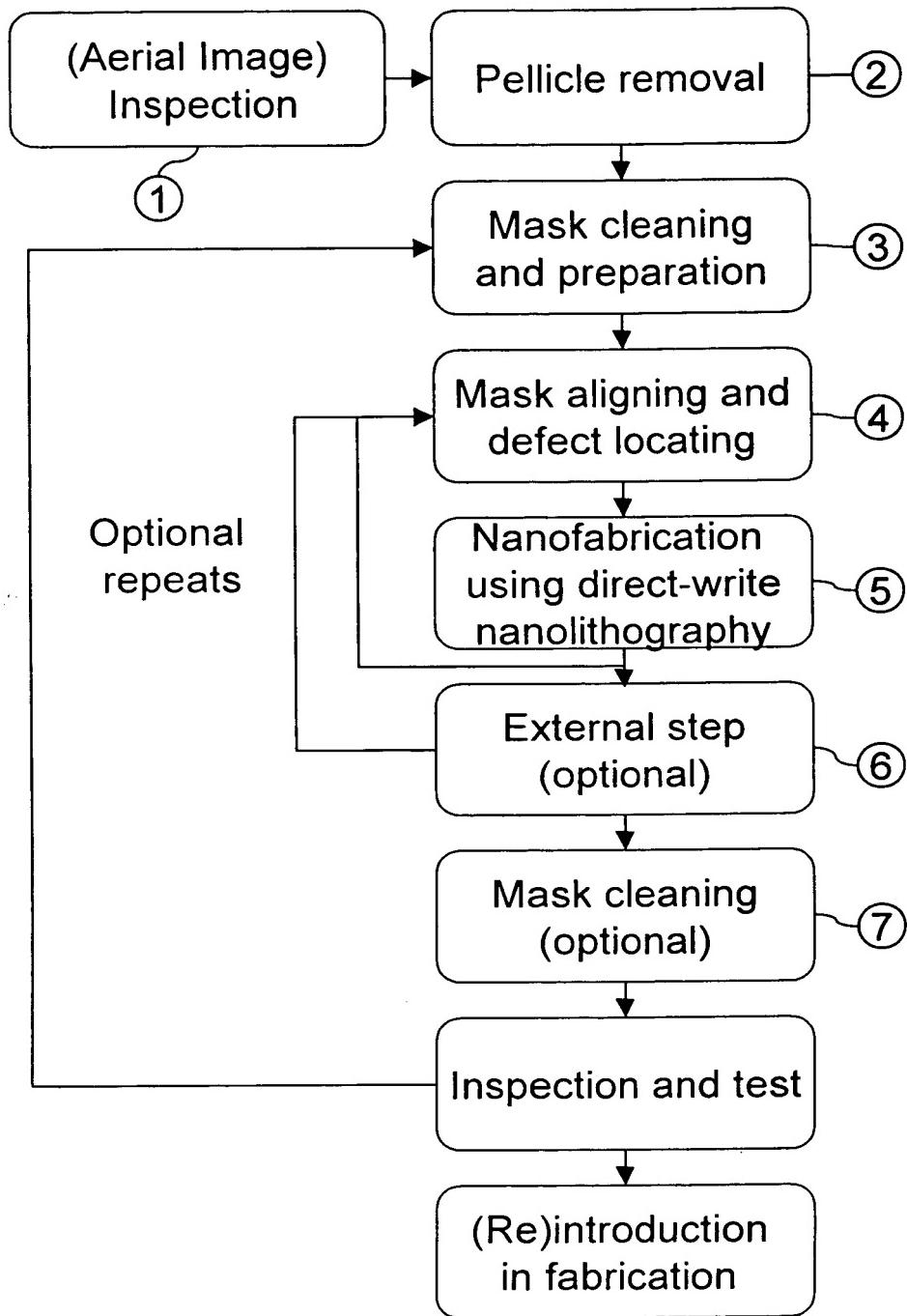


(d)

(e)

(f)





**Figure 13**

Figure 14A

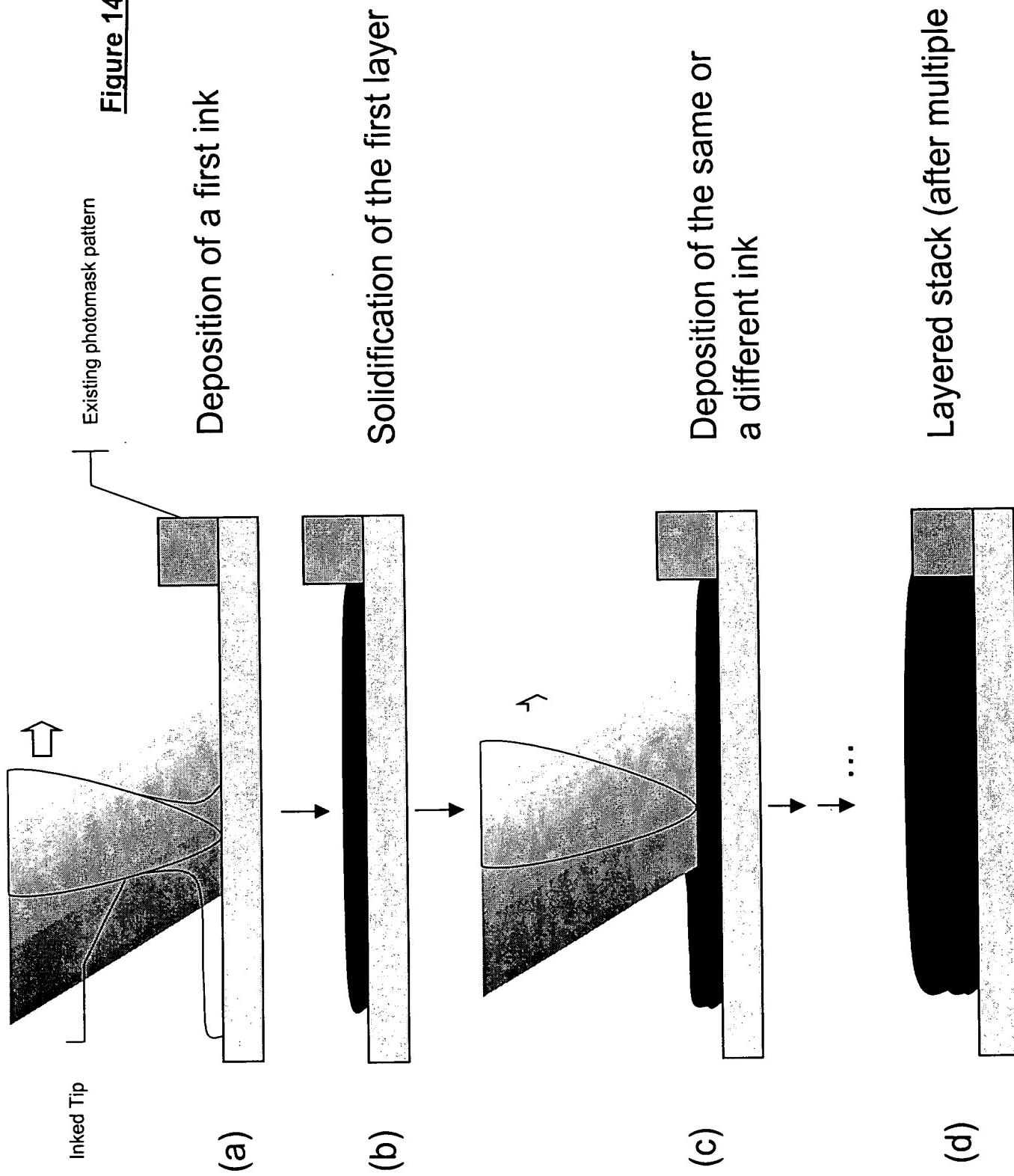


Figure 14B

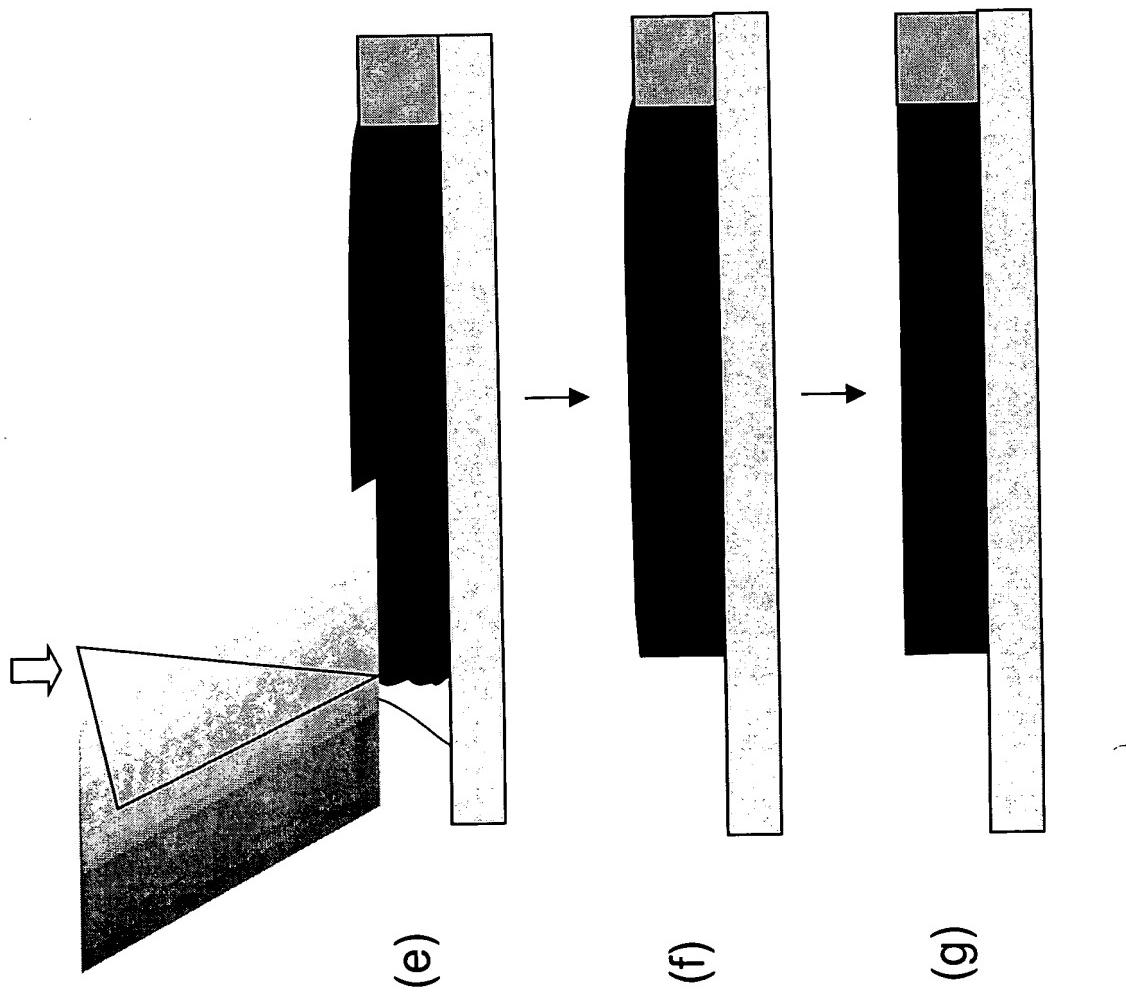
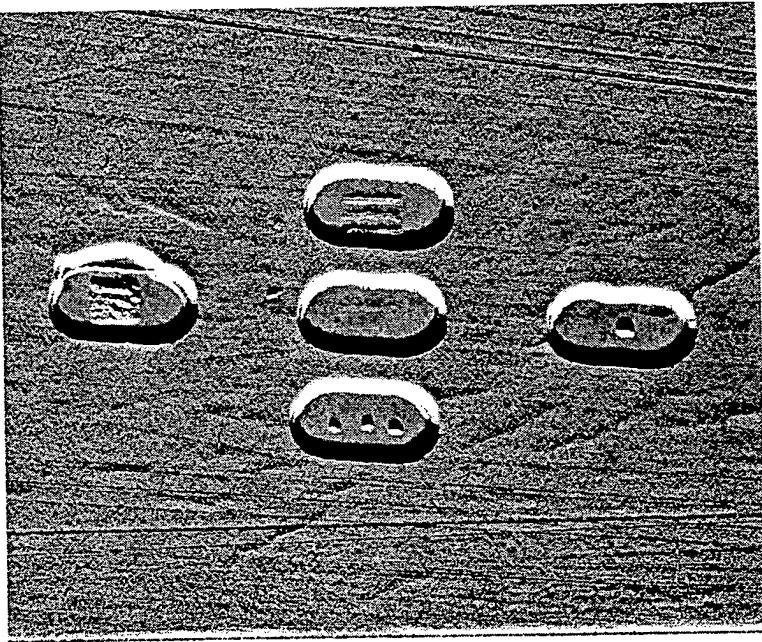
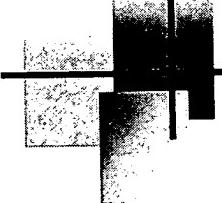


Figure 15

## Zoomed Out View

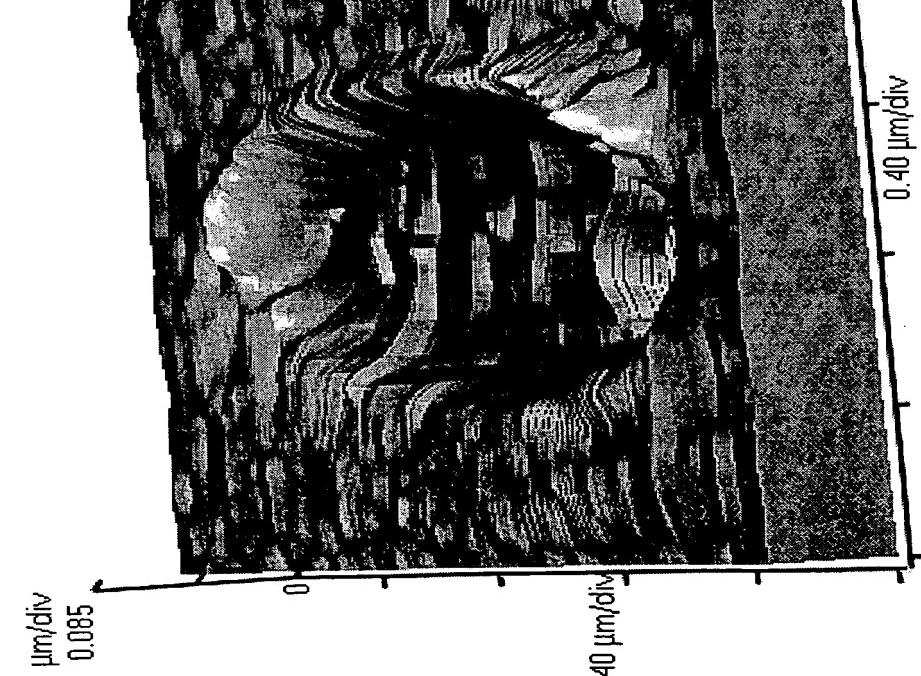
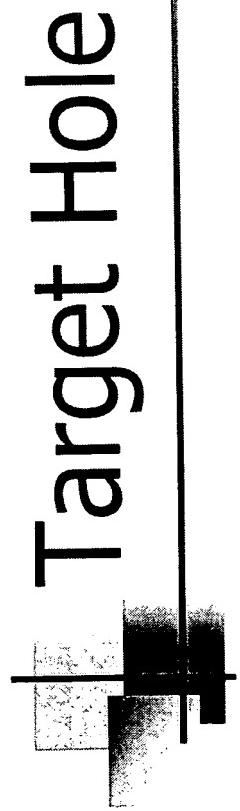


Sol-Gel Structures in one of  
the smallest features in Binary  
Mask

The features (5 holes) in the  
mask are  $1\mu\text{m} \times 2\mu\text{m}$ .

Nano Structures were  
successfully created in smaller  
features too.

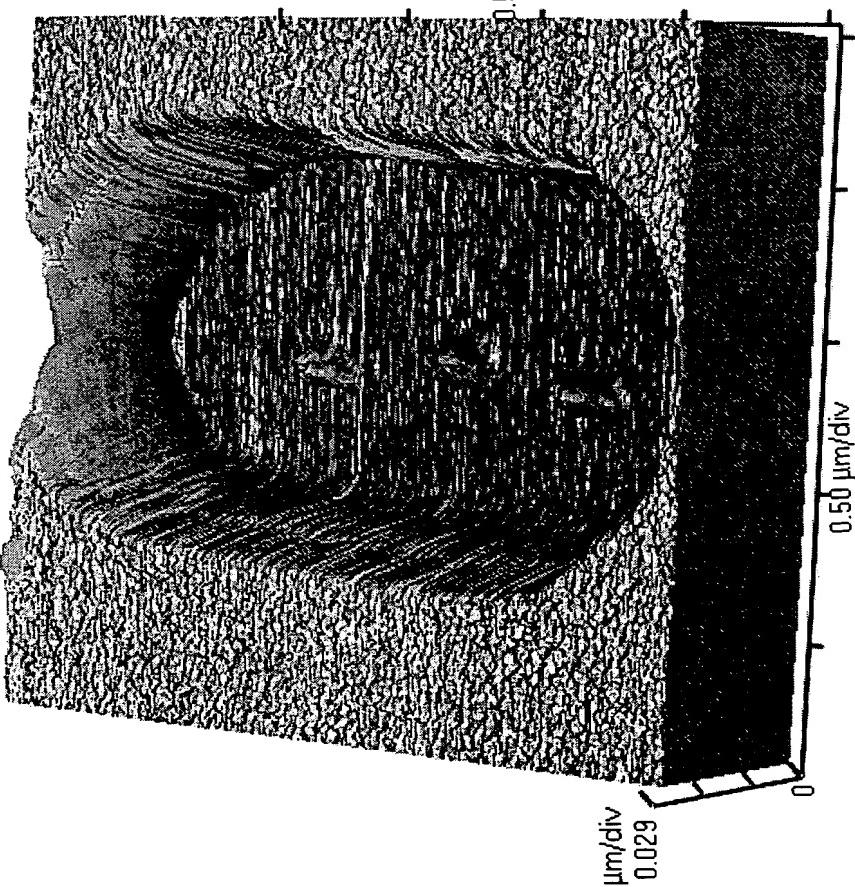
Figure 16



Shown was the target feature to be used for deposition of Sol-Gel structures  
The dimensions of the hole are  
**Length 2  $\mu\text{m}$**   
**Width 1  $\mu\text{m}$**   
**Height 75 nm**

# Dots in the Features

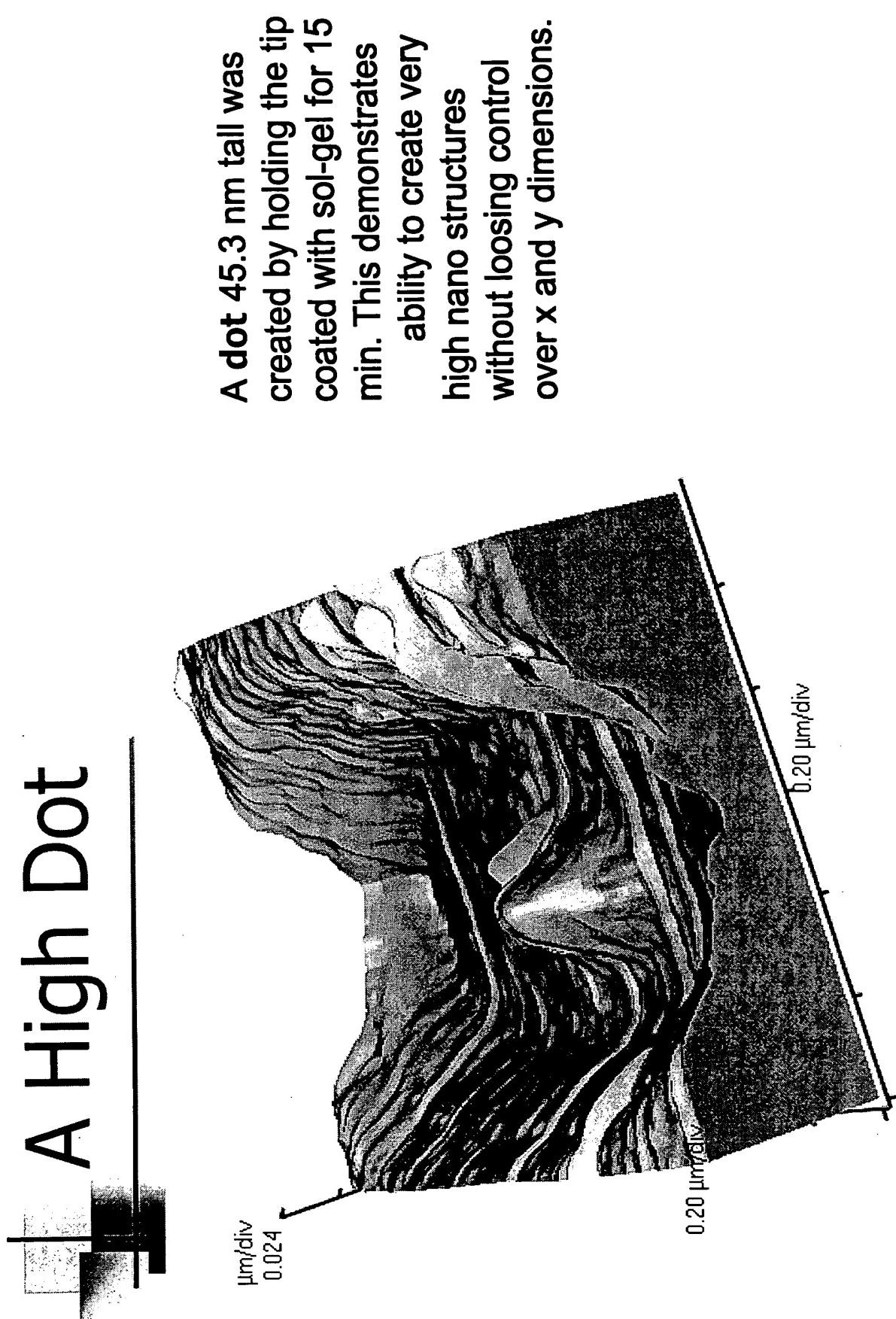
Figure 17



Dots were created, demonstrating the control over height of the feature and the registration. The dimensions starting from top feature

- H 17 nm W 128 nm T 3 min
- H 17.5 nm W 150 nm T 3.5 min
- H 18.5 nm W 163 nm T 4 min

Figure 18



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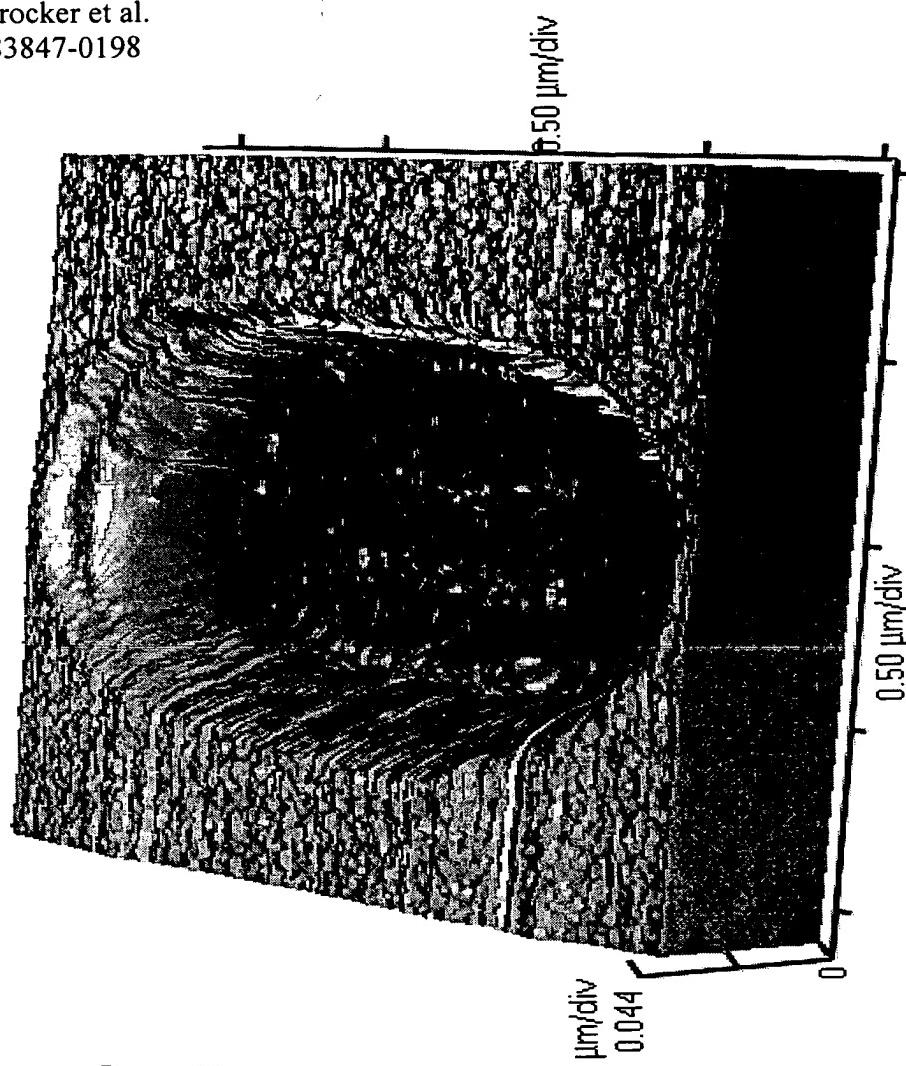
Attorney Docket No.: 083847-0198

**Figure 19**

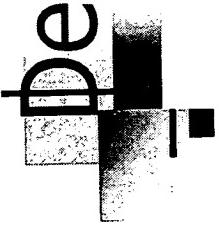
## Lines in the Feature

These three lines were created, one exactly alongside the defect edge. The dimensions for the lines starting from left are:

- H 15 nm W 162 nm T 6 min
- H 10 nm W 150 nm T 5 min
- H 5 nm W 138 nm T 4 min



# Target Hole on FIBics Structures for Deposition of Metal Salt and sol-gel



This hole is ~200 nm wide and 100 nm deep. This was the target hole for deposition of sol-gel structure and metal ink.

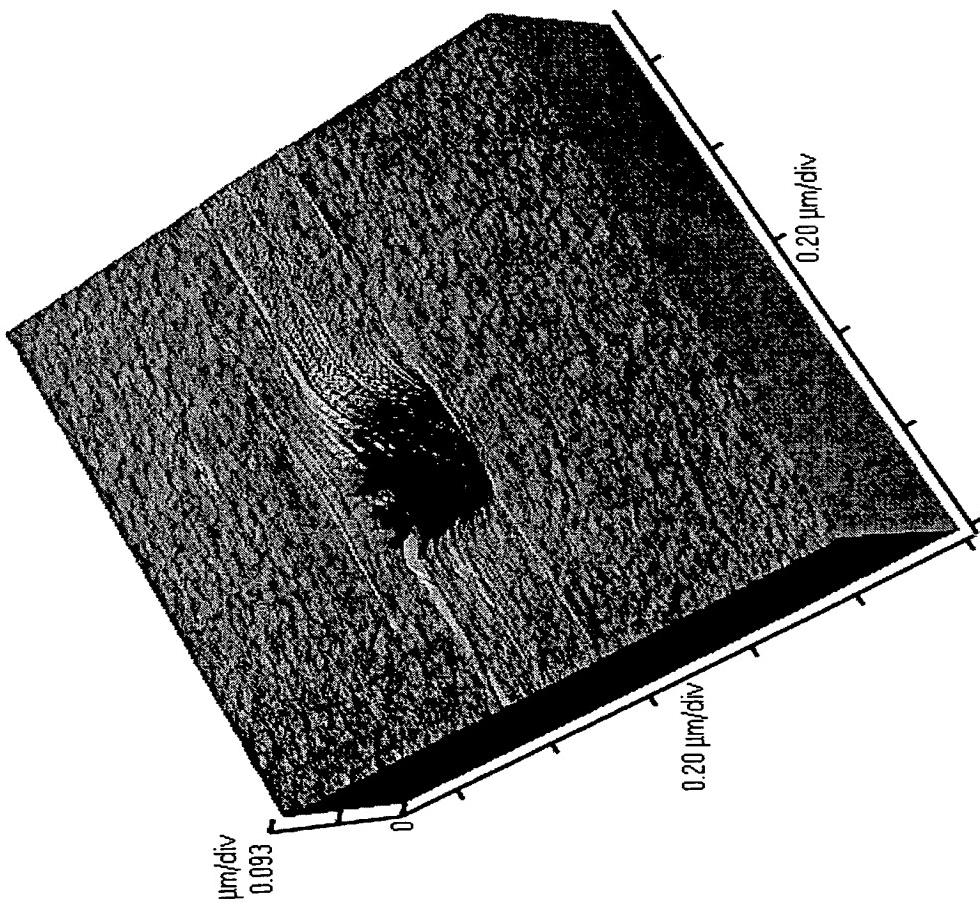
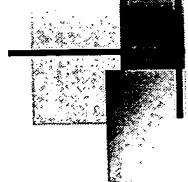


Figure 20

# Sol-Gel in Features by FIBICS



An attempt to fill up a hole in features made with FIB. The average height of the feature deposited is 46 nm. A  $\text{SiN}_3$  tip was used in this experiment.

Sol-Gel composition same as mentioned before. Dwelling time was 14 min. The deposited structure were cured at 120° C for 6 min.

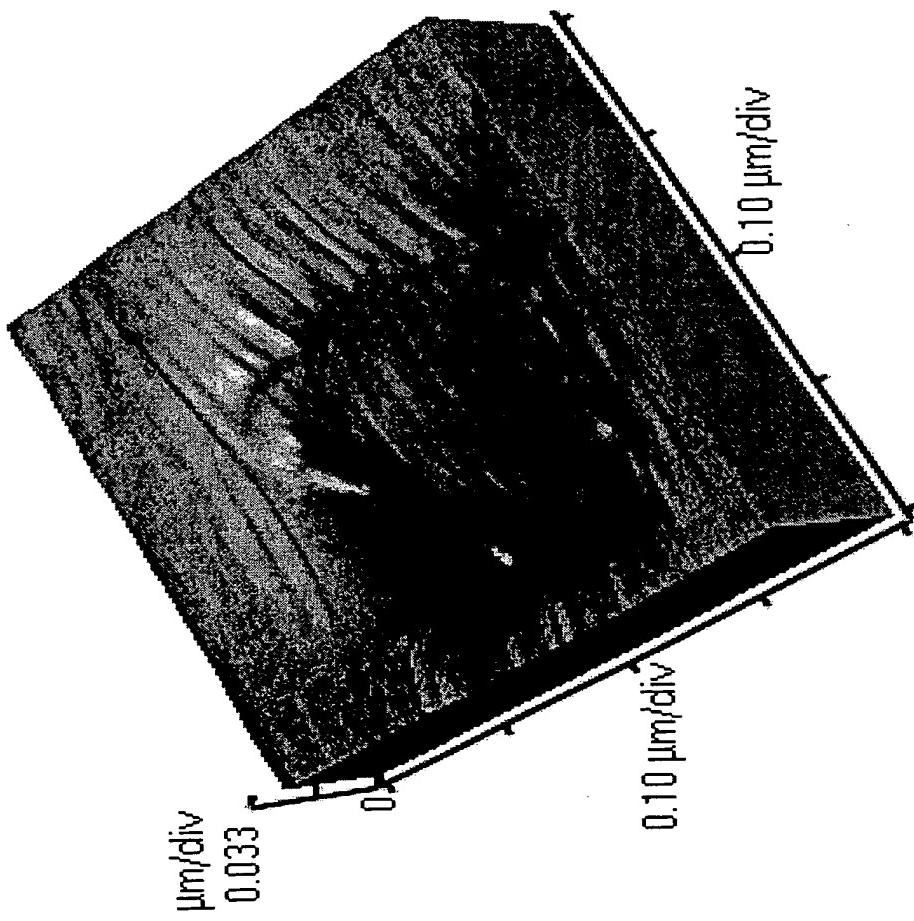
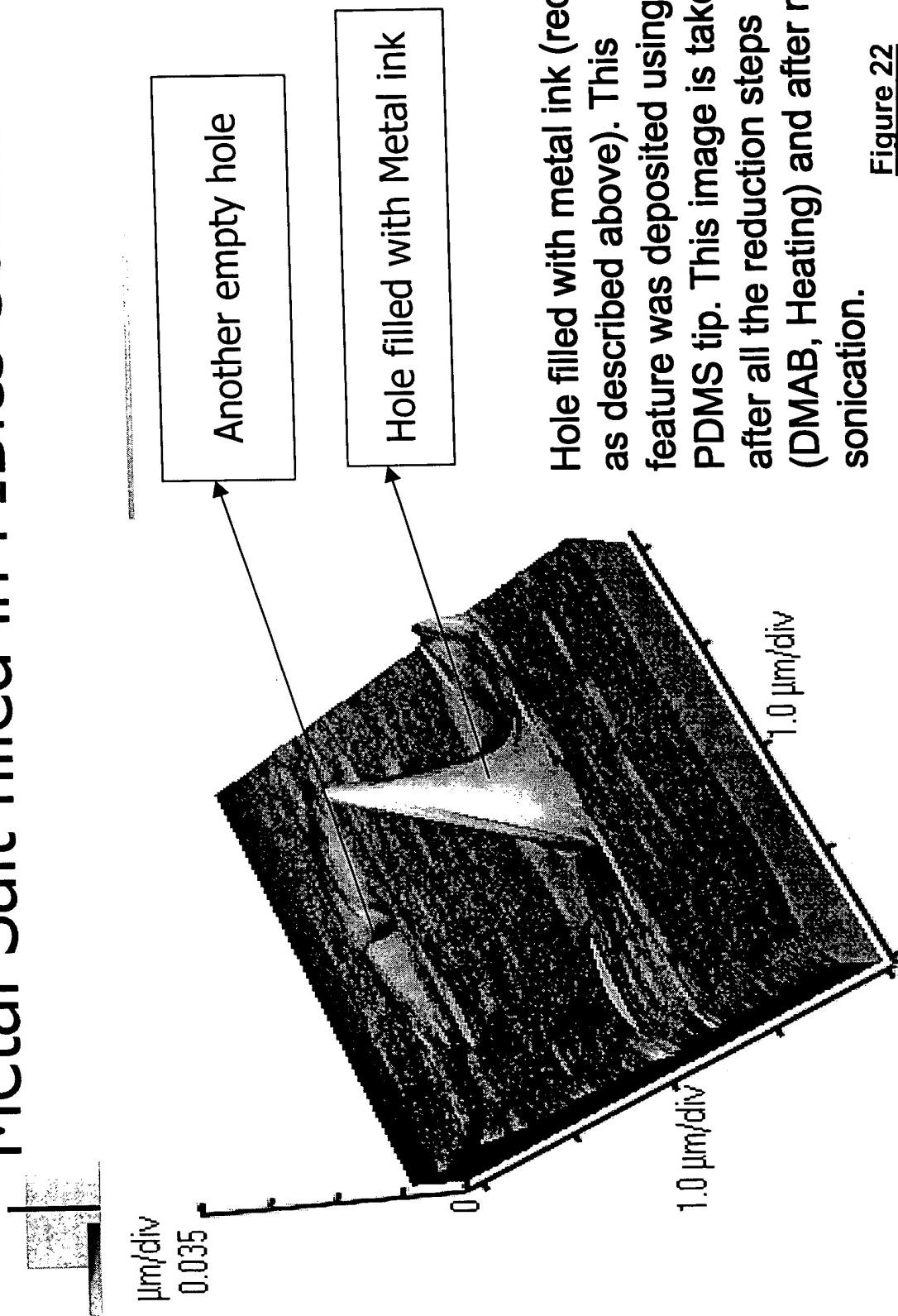


Figure 21

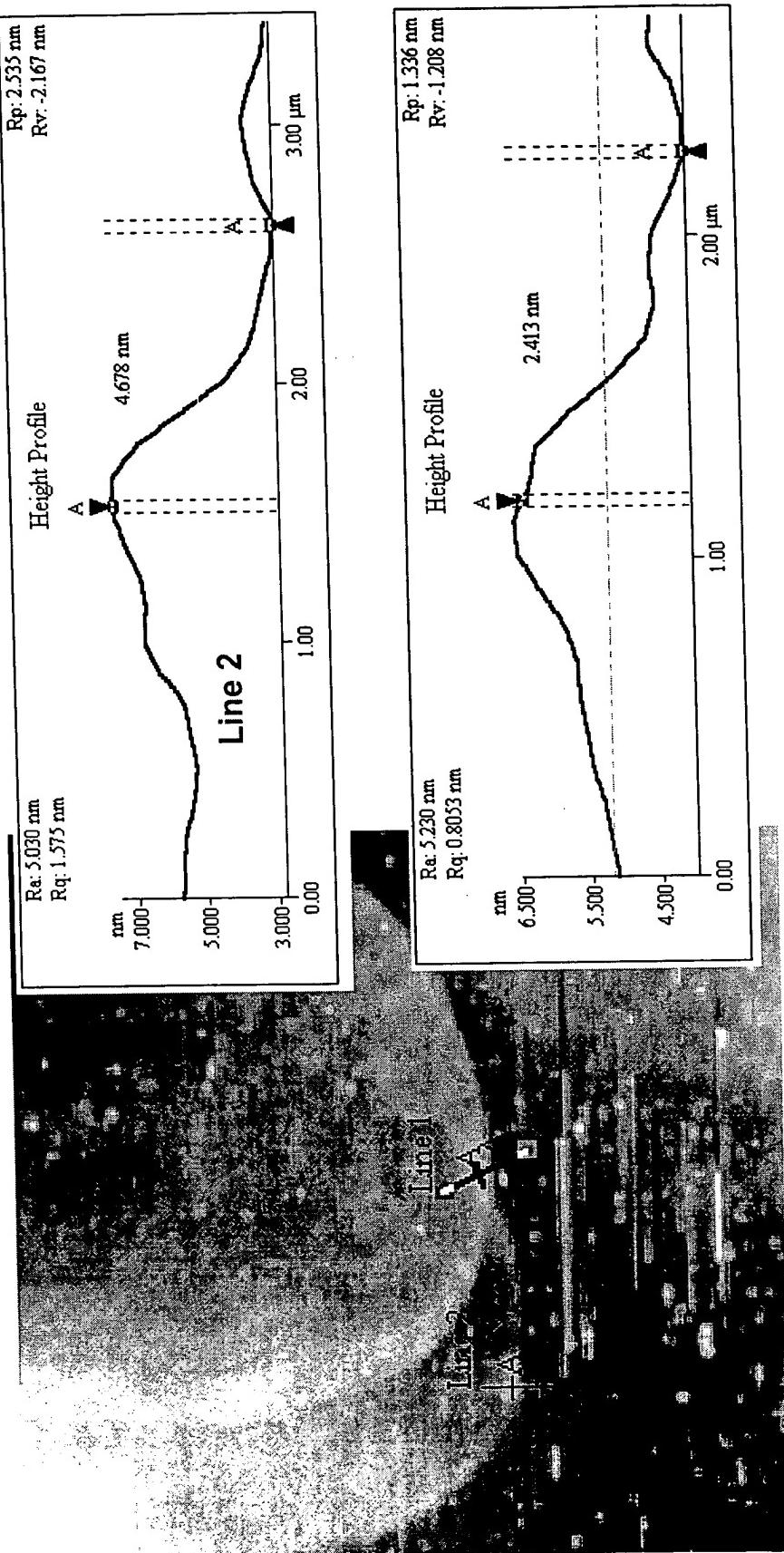
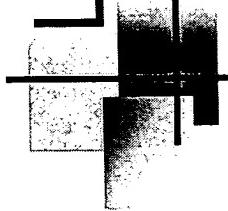
# Metal Salt filled in FIBics Structures



Hole filled with metal ink (recipe as described above). This feature was deposited using a PDMS tip. This image is taken after all the reduction steps (DMAB, Heating) and after mild sonication.

Figure 22

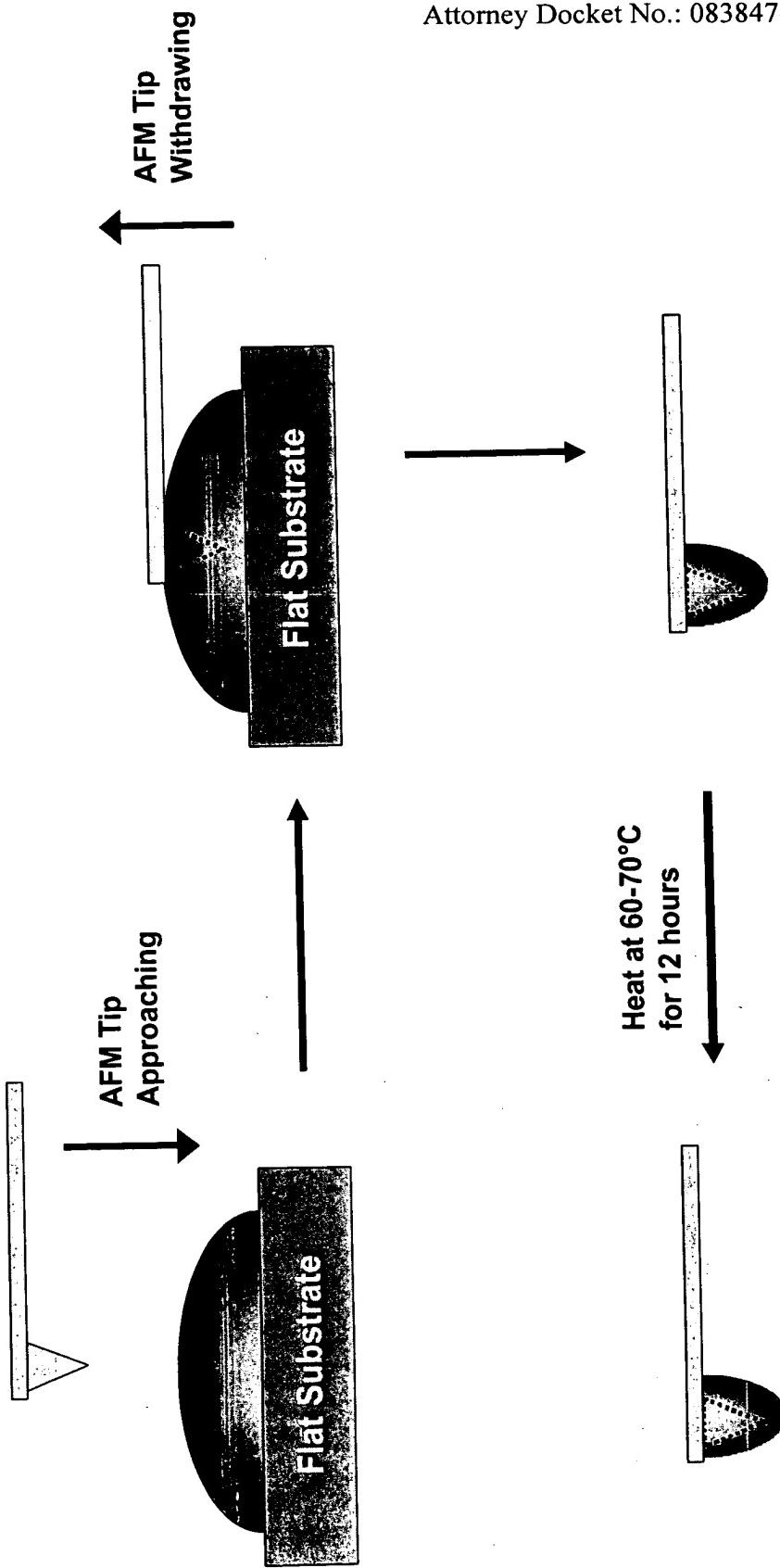
# Building up of Metal Structure by Layering



**Figure 23**

# Schematic Representation: Fabrication of PDMS-Coated DPN Stamp Tip

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PDMS-coated DPN Stamp tip

Figure 24

# Optical Microscopy Image of a PDMS-Coated DPN Stamp Tip

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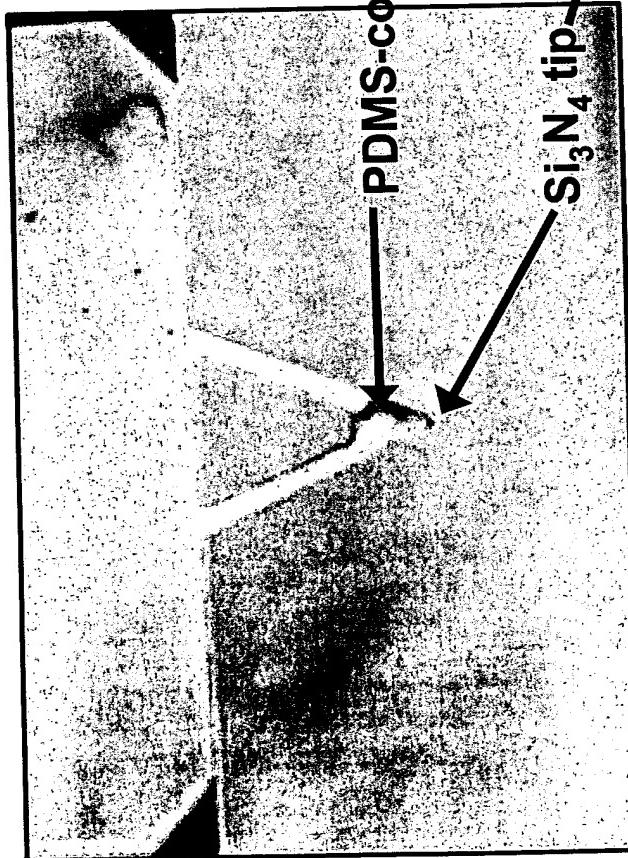
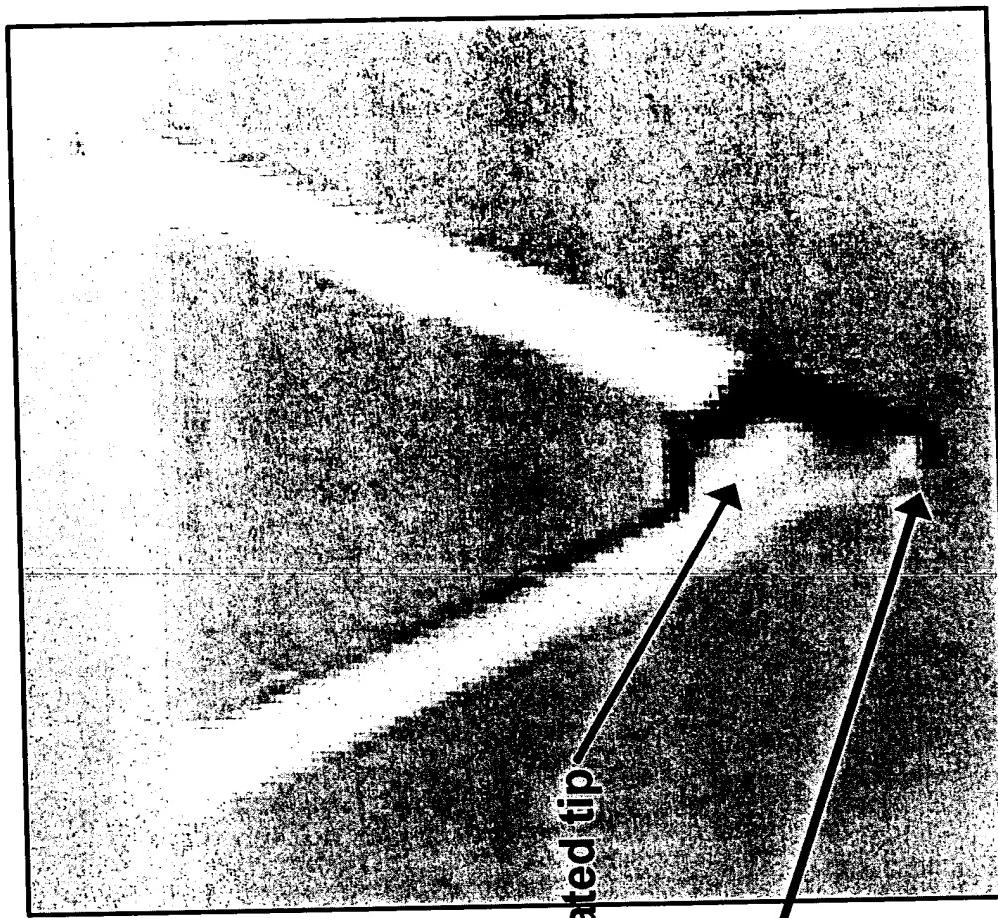
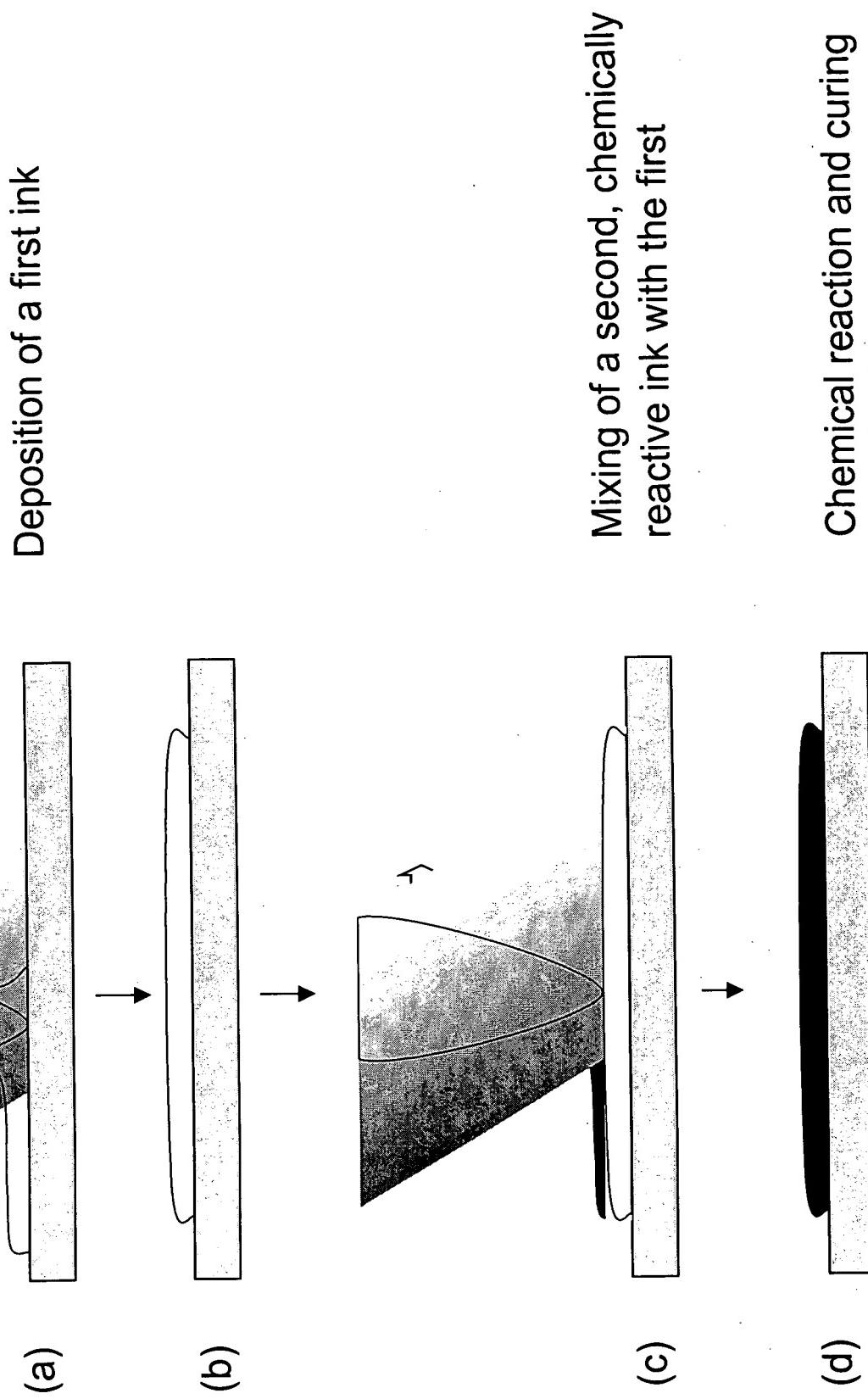


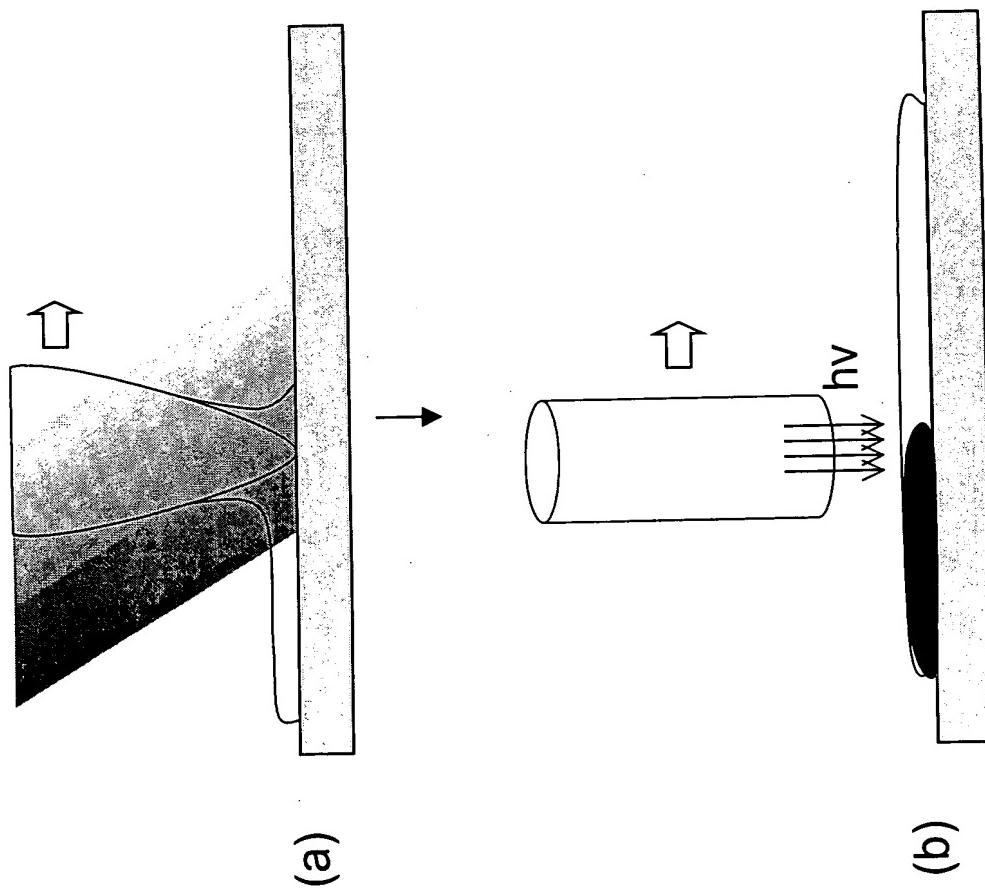
Figure 25

**Figure 26**



Deposition of a first ink

Local curing by irradiation  
from a NSOM tip



**Figure 27**